3-1-1918

Emmer in South Dakota

Manley Champlin

J.D. Morrison

BULLETIN NO. 179 MARCH 1918

AGRICULTURAL EXPERIMENT STATION

In Co-operation With United States Department of Agriculture
Bureau of Plant Industry

SOUTH DAKOTA
STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

CONTRIBUTION FROM

AGRONOMY DEPARTMENT

A. N. HUME, Head of Department

EMMER IN SOUTH DAKOTA

BROOKINGS, SOUTH DAKOTA

Bowen Pub. Co. Huron, S. D.

GOVERNING BOARD

Hon. T. W. Dwight, President.....Sioux Falls, S. D.
Hon. August Frieberg, Vice-Pres.....Beresford, S. D.
Hon. T. A. Potwin.....Lemmon, S. D.
Hon. Frank Anderson .....Webster, S. D.
Hon. J. W. Campbell .....Huron, S. D.

STATION STAFF

T. W. Dwight .....Regent Member
J. W. Campbell .....Regent Member
Ellwood C. Perisho .....President of College
James W. Wilson....Director and Animal Husbandman
N. E. Hansen .....Vice-Director and Horticulturist
James H. Shepard .....Chemist
C. Larsen .....Dairy Husbandman
A. N. Hume.....Agronomist and Supt. of Sub-Stations
Harry C. Severin..... Entomologist
J. G. Hutton .....Associate Agronomist
Manley Champlin...Ass't Agronomist and Collaborator
Howard Loomis .....Agronomy Analyst
George Gilbertson..... Assistant Entomologist
Matthew Fowlds .....Assistant Agronomist
George Winright .....Assistant Agronomist
E. H. Hungerford.....Dairy Analyst
Reginald Sherwood .....Assistant Chemist
J. M. Eldridge .....Assistant Dairy Husbandry
J. D. Morrison, Scientific Assistant, Detailed by U. S. Department of Agriculture.
B. L. Thompson.....Assistant Animal Husbandman
T. H. Wright.....Assistant Dairy Husbandman
R. A. Larson .....Secretary
P. W. Hanson .....Bulletin Clerk and Stenographer

EXPERIMENT FARMS

Brookings ..... Brookings County
Cottonwood .....Jackson County
Eureka .....McPherson County
Highmore .....Hyde County
Vivian .....Lyman County

EMMER IN SOUTH DAKOTA

By Manley Champlin and J. D. Morrison

Inquiries are being received requesting information in regard to emmer as a war crop for South Dakota, the impression being that this crop would assist in solving the food problem, because of its ability to produce twice as many pounds per acre as spring wheat.

This gives an excellent opportunity to correct a number of false impressions in regard to emmer as a crop for South Dakota conditions.

Please note the term emmer is used exclusively. The reason for this is that there is practically no speltz being grown in South Dakota. The commonly called speltz is not true speltz, but belongs to an altogether different branch of the wheat genus. This grain that is com monly spoken of as speltz is emmer.

Emmer has been grown in South Dakota as a grain crop for at least twenty years. Experiments with this crop have been conducted at the State College experiment farms at Brookings, Cottonwood, Eureka, Highmore and Vivian.

Varietal tests begun at Brookings in 1902 and continued until 1908 clearly demonstrated the White Spring, C. I. No. 1524, as the leading variety among those introduced. A selection of this variety called S. D. No. 3 proved slightly superior to the bulk seed in yield, but after distribution, has lost its identity as a separate strain. Most of the emmer grown in South Dakota is of this White Spring variety.

In considering emmer as a war crop, its value as food for man or animal must be taken into consideration. It is necessary then to compare it with wheat, rye, barley, and oats to gain some idea of its relative value as a grain crop. In comparing emmer with such other hulled crops as barley and oats, and hull-less crops as wheat and rye; the relative waste and loss of food value due to this percentage of hull must be considered. Emmer carries

from 22 to 30 per cent hull, varying of course with seasonal conditions. The average under South Dakota conditions can be figured as about 25 per cent. Barley averages about 10 per cent hull. Oats has a slightly higher percentage of hull than emmer, an average of about 28 per cent for Sixty Day oats, the leading variety for South Dakota.

Comparison of Emmer with other Grain Crops at Brookings

The experiments at Brookings comparing emmer with various other grain crops having a somewhat similar use are divided into two distinct periods. During the earlier five-year period, 1904 to 1908, a comparison between emmer, spring wheat, barley and oats is available, while in the second five-year period, 1913 to 1917, winter wheat and winter rye are also included in the comparison. During the earlier period the wheat and emmer are directly comparable, while the barley and oats are usually at a disadvantage owing to the preceding crop or the soil treatment. The wheat and emmer in these earlier tests were usually planted on corn ground. Barley and oats were generally sown on fall plowing. During the second period all of the crops compared followed corn and the land was manured once in four years ahead of corn. Table I presents the average yields for each period and for the entire ten years. The leading variety of each crop for each period is used in making up the average for that crop. No emmer was grown during the years 1909 to 1912, inclusive.

TABLE I.—COMPARISON OF EMMER WITH VARIOUS OTHER SMALL GRAINS AT BROOKINGS 1904 TO 1917.

	Average Yields in Pounds Per Acre.		
	1904 to 1908	1913 to 1917	10 years
Emmer	1856	1880	1868
Durum, Spring wheat	1132	1069	1100
Winter wheat	....	1763	....
Winter rye	....	2376	....
Spring barley	2082	2490	2286
Spring oats	1987	2298	2142

A study of Table I shows both barley and oats to have produced from 10 to 20 per cent more grain than

emmer. Winter rye has given a production 27 per cent greater than emmer. Winter wheat has almost equalled the emmer in yield, while spring wheat has given a yield almost 60 per cent as great as the emmer. It is very evident from the showing made that emmer should be the last crop to be selected as a means of increasing grain supplies for war purposes, in the eastern third of South Dakota , as represented by the experiment farm at Brookings. Barley is the highest producing feed crop for this section.

Comparison of Emmer with other Grain Crops, at Cottonwood

The tests comparing emmer with other small grains were started at Cottonwood in 1912. A direct comparison of emmer and barley for the five-year period, 1912 to 1916, is possible in three different rotations. In each case the barley and emmer follows a cultivated crop. The average acre yields for the five-year period have been 416 pounds of emmer and 242 pounds of barley. The emmer gave some yield in two seasons when the barley was a failure. In 1912 cutworms took the barley but did not injure the emmer, and in 1915 early hail destroyed the barley while the emmer made a crop after being injured by the hail. The yield of neither crop has been profitable as an average.

Probably a more satisfactory comparison between emmer and the other small grains is that of a single year, 1916, when all crops followed fallow. In this test the yield in pounds per acre for each crop was as follows:

Emmer	1070
Durum spring wheat	930
Winter wheat	1280
Winter rye	1510
Spring barley	1240
Spring oats	930

It is well to note from these yields that emmer did

not produce as much as any other crop except spring wheat and oats, and the only one of these crops that it can be considered to compete with is the oats, as the wheat yield is higher than would be that of the emmer without its hulls. Winter rye is the only grain crop that has produced profitable yields during the past five years at Cottonwood. Winter rye is therefore the best war crop for this area.

Comparison of Emmer With Other Grain Crops at Eureka.

Experiments with emmer were started at Eureka in 1912. Three rotations are being conducted here which have emmer and other grain crops in comparison. Rotation No. 2 is a four-year rotation in which emmer and barley are in direct comparison and follow a crop of millet and proso. During the six-year period, 1912 to 1917, the emmer has given an average yield per acre of 953, while barley has produced 1131 pounds. In Rotation No. 6, which is a five-year rotation of sweet clover or field peas; corn and millet; barley and emmer; corn and wheat, the barley and emmer are very closely comparable as the barley follows a cultivated crop of corn on adjoining plats on the same acre in the rotation. The wheat follows the crop of corn which is grown immediately succeeding the barley, and emmer. This difference in location of crops in the rotation would tend to be in favor of the emmer if any difference existed. Under these conditions for the six-year period, 1912 to 1917, the average acre yield of the three crops has been emmer 1172 pounds, durum spring wheat 941 pounds, and spring barley 1606 pounds. In rotation No. 7, a seven-year rotation supplemented with alfalfa; emmer, barley, and

oats follow proso, Sudan grass and millet, respectively. The proso, Sudan grass and millet are all grown in cultivated rows . Wheat follows corn at another stage in the rotation . The comparison between these crops is not as direct as could be desired, but at least it is a good indication; the emmer having as good an opportunity, if not better, to produce a maximum yield, than the other crops. The average yield, in pounds per acre, of these crops under comparison for the six-year period, 1912 to 1917, has been emmer, 1392 pounds, spring wheat, 902 pounds, spring barley, 1572 pounds, spring oats, 1499 pounds.

It is very apparent from a study of the results of these three rotations that emmer will not produce as many pounds per acre as either barley or oats in the north central part of South Dakota as represented by the Eureka experiment farm . In this area, emmer does not produce enough more than spring wheat to warrant giving it preference as a food crop, per cent of hull and milling quality considered.

Comparison of Emmer with other Grain Crops at Highmore

The most complete comparison of emmer with the various other grain crops is available at Highmore. Emmer has been continuously grown in comparison with other crops since 1903 at this point. It is, therefore possible to make a comparison of emmer, spring wheat, barley and oats for this fifteen-year period . Winter wheat and rye were not introduced in the test at High-

more until 1905, and they were not grown during the years 1909 and 1910. The record of the yield of winter rye was lost for 1908 so this year is not included in the second average column of Table II,which presents the average yields of the various small grains for these two periods. The yields of wheat, emmer and rye are directly comparable during the entire period, but the barley and oats were handicapped at least in some of the seasons between 1903 and 1910, inclusive,owing to the previous cropping experience being less favorable to a maximum production.

Table II. Comparison of emmer with various other grain crops at Highmore, 1903 to 1917.

Crop	Average Yield in Pounds Per Acre	
	1903 to 1917	1905-1907 and 1911-1917
Emmer	1242	1309
Spring wheat	967	932
Winter wheat		722
Winter rye		1255
Spring barley	1221	1367
Spring oats	1224	1352

It is evident from the showing made by emmer, over this long period of time, that unless it has a higher food value than barley or oats, it would not be as valuable a crop as either of these. It has produced only a very little more than winter rye which is far more valuable pound for pound, besides assisting in a more satisfactory distribution of labor. Even when compared with spring

wheat the slightly larger yield of emmer, when considered on a hull-less basis, would not be sufficient to offset the better milling quality of the wheat. Emmer is compared with the various other small grains under directly comparable conditions in four different rotations at Highmore. Although these comparisons cover only two and three-year periods, they so directly support and confirm the evidence of the longer tests that it is thought well to include them. The yields are recorded in pounds per acre.

TABLE III.—EMMER IN ROTATIONS AT HIGHMORE.

CROP	Continuous small grain averages		Fallow and small grain averages		Corn and small grain averages		Corn, legum and small grain averages		Average of all Rotations	
	1915 1916 1917	1916 1917	1915 1916 1917	1916 1917	1915 1916 1917	1916 1917	1915 1916 1917	1916 1917	1915 1916 1917	1916 1917
Emmer.	1237	660	1430	945	1487	1055	1463	1055	1404	929
Spring wheat .	773	591	966	868	1105	940	984	1000	957	850
Winter wheat	.....	675	.....	965	1280	1350	.....	1270	.....	1065
Winter rye . .	.....	945	1723	1745	1467	1475	.....	1950	.....	1529
Spring barley .	1663	1155	1723	1420	1783	1445	1820	1545	1747	1391
Spring oats . .	1770	1155	2370	1915	2077	1540	2086	1650	2076	1565

A study of tables 2 and 3 shows spring wheat to be the only crop that has produced less pounds per acre than emmer as an average of all rotations, and in this case the spring wheat approaches the emmer so closely in production that it would be the more valuable crop of the two.

More Emmer Per Acre

The foregoing data shows that emmer is probably the least valuable of the important small grain crops grown in South Dakota. The only object in growing it is that it adds one crop to the list of those which can be

grown and thus gives a chance to diversify. With the varying seasons diversification is a form of crop insurance. On this account certain studies have been made with a view to learning more about emmer production. By utilizing the information gained from these tests, it will be possible to grow more emmer per acre.

Rate-of-Seeding Experiments

A rate-of-seeding experiment using four, six and eight pecks per acre has been conducted at Eureka during the five-year period, 1913 to 1917. This test has shown a profitable increase in production for the six peck rate over either the lighter or heavier rate of seeding.

Date of Seeding Experiment

The date-ofseeding experiments with emmer have been conducted at Highmore for the past four years. The- date-of-seeding experiments seem to offer the most promising solution of a number of dry farming problems, and the results are so strikingly in favor of early seeding that from a farm management point of view a rearrangement of farm practice should be made to take advantage of this easily available method of increasing farm profits.

The results of early seeding of emmer are as striking as with other crops. Satisfactory averages are difficult to obtain so the entire data giving annual and average yields are presented in Table IV.

A careful study of Table IV is well worth while. It

shows that emmer should be seeded as early as possible if maximum yields are to be obtained. A further fact of interest is that the earliest seeding each season is drilled without any soil preparation, thus eliminating a large amount of work at the most critical work period of the year.

TABLE IV. Annual and average yields obtained in a date-of-seeding test with White Spring Emmer S. D. 293 (C. I. No. 1524) at Highmore 1914 to 1917.

	Yield in Bushels per Acre				Averages	
Date of seeding	1914	1915	1916	1917	1914-17	1914-16
March 16	....	....	71.9	....	.....	.....
April 1 to 12	78.0	112.5	56.2	41.8	72.1	82.2
April 15 to 22	56.3	112.5	57.8	....	.....	75.5
May 1 to 7	57.9	82.5	25.0	33.6	49.7	55.1
May 15	....	....	....	25.8	.....	.....

All seedings have been made in clean corn ground and all seedings except the earliest one have had the additional advantage of a double discing and double harrowing of the corn ground prior to the drilling of the seed. The advantages of early seeding cannot be more clearly demonstrated than in the actual yields obtained. Additional advantages for the early seeding are the better quality of grain, the checking of weed growth, and earlier ripening, thus reducing the chance of loss from hail and disease and making it possible to prepare the ground early for use by the following crops, as well as to store moisture from late summer and fall rains.

LIST OF AVAILABLE BULLETINS.

105. Stock Food for Pigs.
106. Sugar Beets in South Dakota.
107. Sheep Scab.
111. A Study of South Dakota Butter with suggestions for improvement.
114. Digestion Coefficient of Grains and Fodders for South Dakota.
129. Growing Pedigreed Sugar Beet Seed in South Dakota.
130. Some New Fruits.
131. Scabies (Mange) in Cattle.
132. Effects of Alkali Water on Dairy Products.
134. More Winter Dairying in South Dakota.
136. Fattening Pigs.
142. Sugar Beets in South Dakota—Results to Date.
143. Roughage for Fattening Lambs.
144. Preliminary Report on the Milking Machine.
145. A Report of Progress in Soil Fertility Investigations.
146. Some varieties and Strains of Wheat and Their Yields in South Dakota.
147. Effect of Alkali Water on Dairy Cows.
148. Corn Silage and Mill Products for Steers.
149. Some Varieties and Strains of Oats and Their Yields in South Dakota.
151. Trials with Sweet Clover as a Field Crop in South Dakota.
152. Testing and Handling Dairy Products.
153. Selecting and Breeding Corn for Protein and Oil in South Dakota.
154. The Pit Silo.
155. Selection and Preparation of Seed Potatoes, Size of Seed Pieces, and Bud-Variation.
156. Kaoliang, A New Dry Land Crop.
157. Rape Pasture for Pigs in Corn Field. Kaoliang for Pigs.
158. Proso and Kaoliang for Table Food.
159. Progress in Plant Breeding.
160. Silage and Grains for Steers.
161. Winter Grain in South Dakota.
162. First Annual Report of Vivian Experiment and Demonstration Farm.
163. Comparative Yields of Hay, from Several Varieties and Strains of Alfalfa, at Brookings, Highmore, Cottonwood and Eureka.
164. Making Butter and Cheese on the Farm.
165. Corn Silage for Lambs.
166. Important Factors Affecting Machine Milking.
167. Transplanting Alfalfa.
168. Breakfast Foods and Their Relative Value.
169. Flax Culture.
170. Quack Grass Eradication.
171. Cream Pasteurization.
172. Grasshopper Control.
173. Sugar Beets in South Dakota.
174. Sorghums for Forage in South Dakota.
175. The Role of Water in a Dairy Cow's Ration.
176. Potato Culture in South Dakota.
177. The Sheep.
178. Corn Insects in South Dakota.

Note: We do not add the names of non-residents to the regular mailing list.